The Gradient-T SZE: A Direct Measurement of Heat Conductivity in Galaxy Clusters

Makoto Hattori and Nobuhiro Okabe
(Email: hattori@astr.tohoku.ac.jp)
Astronomical Institute, Tohoku University, Japan

The inverse Compton scattering of the cosmic microwave background (CMB) radiation with electrons in the intracluster medium which has a temperature gradient, was examined by the third-order perturbation theory of the Compton scattering. A new type of the spectrum distortion of the CMB was found and named as gradient T Sunyaev-Zel'dovich effect (gradT SZE). The spectrum has a universal shape. There is a zero distortion point at 326 GHz. When the hotter region locates closer to an observer, the intensity becomes brighter than the CMB in the frequency region lower than 326 GHz and fainter than the CMB in the frequency region higher than 326 GHz. The amplitude of the spectrum distortion is proportional to the heat conductivity and the total temperature variation along a line of sight. Therefore, the observations of the gradT SZE by future mm and submm observations provide an opportunity of direct measurement of the heat conductivity and the thermally inequilibrium electron momentum distribution function in the ICM.

From Spitzer to Herschel and Beyond Pasadena, California, June 2004 Conference Program and Abstracts